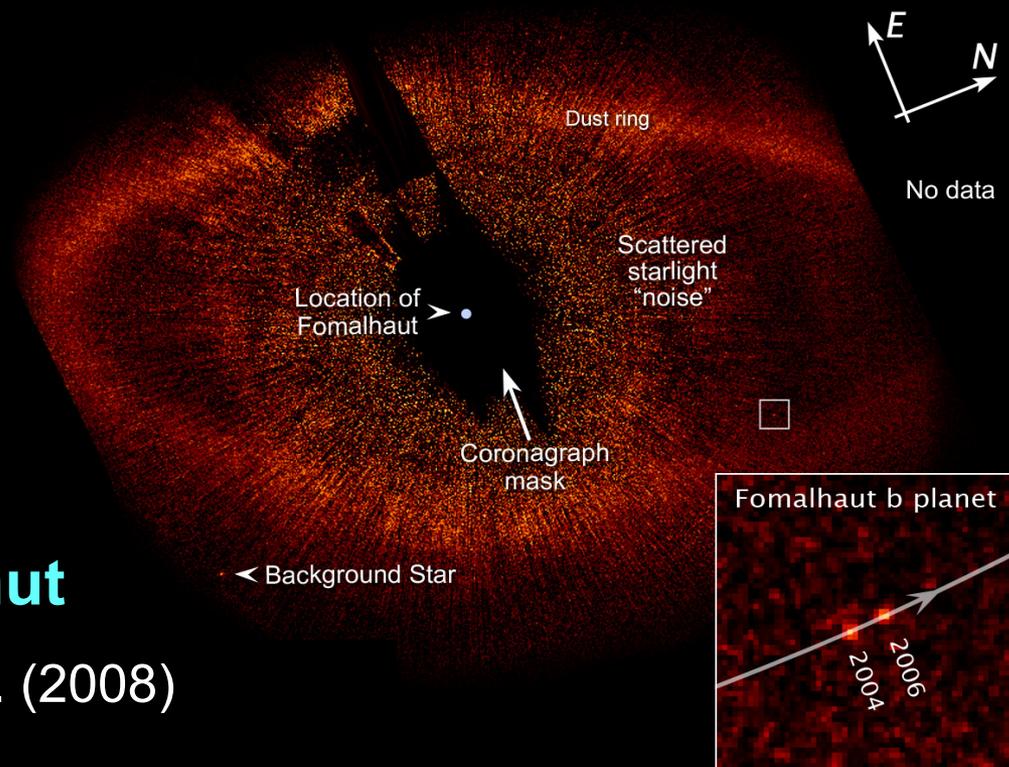


Debris Disks and Exozodi Study Analysis Group

Aki Roberge (NASA GSFC)

Fomalhaut

Kalas et al. (2008)

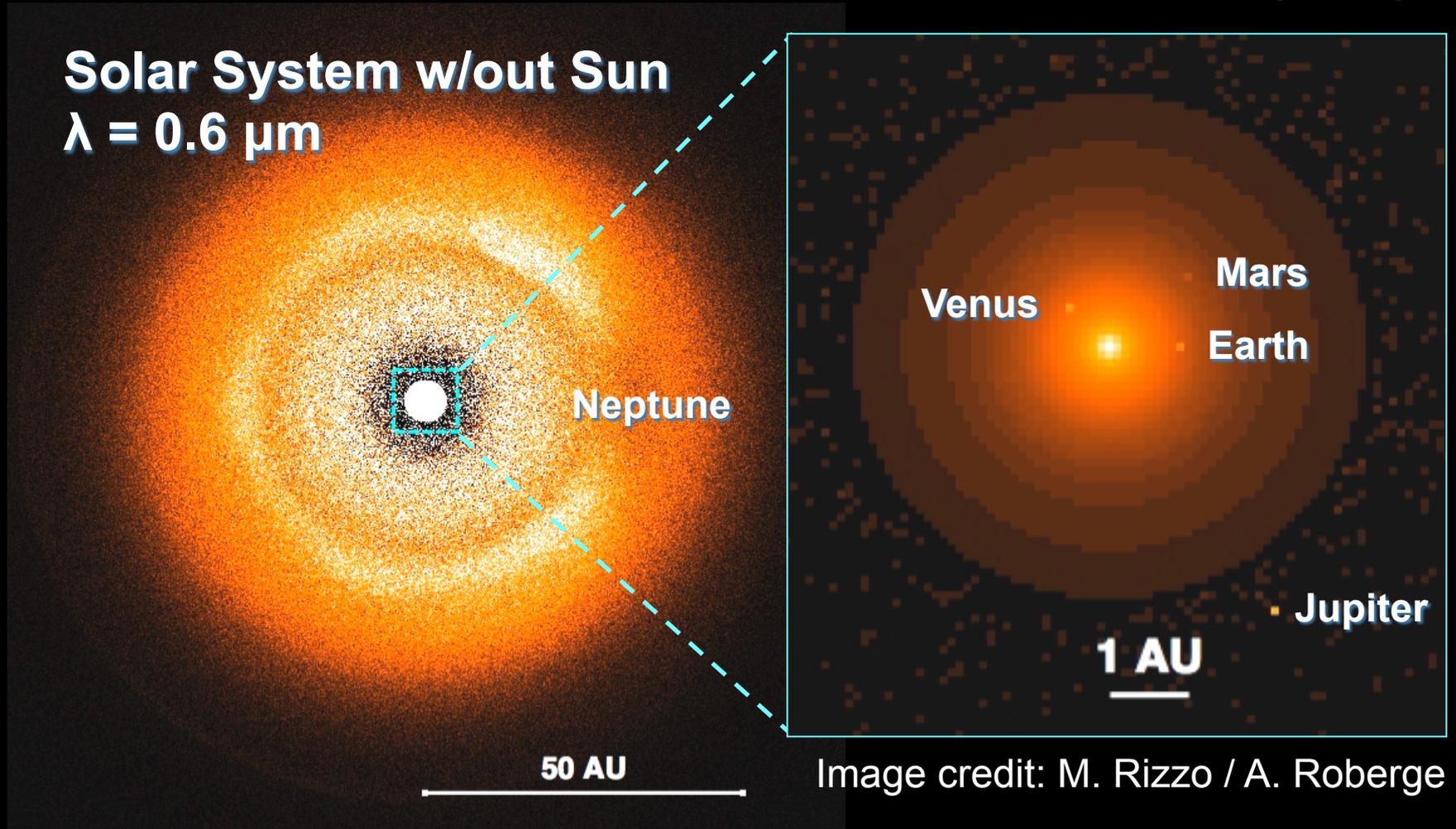


Current SAG Participants

Aki Roberge	NASA GSFC	Bruce Macintosh	LLNL
Olivier Absil	U of Liege	Charley Noecker	Ball
Jean-Charles Augereau	Grenoble	Stephen Ridgeway	NOAO
Geoff Bryden	NASA JPL	Remi Soummer	STScI
Christine Chen	STScI	Chris Stark	Carnegie DTM
Tom Greene	NASA Ames	Alycia Weinberger	Carnegie DTM
Phil Hinz	U of Arizona	Mark Wyatt	Cambridge
Marc Kuchner	NASA GSFC		

- To participate, email Aki.Roberge@nasa.gov

The Problem for Exoplanet Imaging



- Dust models from Kuchner & Stark (2010), Kelsall et al. (1998) + ZODIPIC

Zodi and Exozodi

- Zodiacal dust > 90% cometary (Nesvorny et al. 2009)
 - Recent asteroid collisions make dust bands
- Debris disk parameters
 1. Fractional IR luminosity ($L_{\text{IR}}/L_{\text{star}}$) → dust abundance
 2. Dust temp (T_{dust}) → distance
- Solar System defines “1 zodi”
 - In practice, 1 zodi is $L_{\text{IR}}/L_{\text{star}} = 10^{-7}$
 - Beta Pic : ~ 10,000 zodis

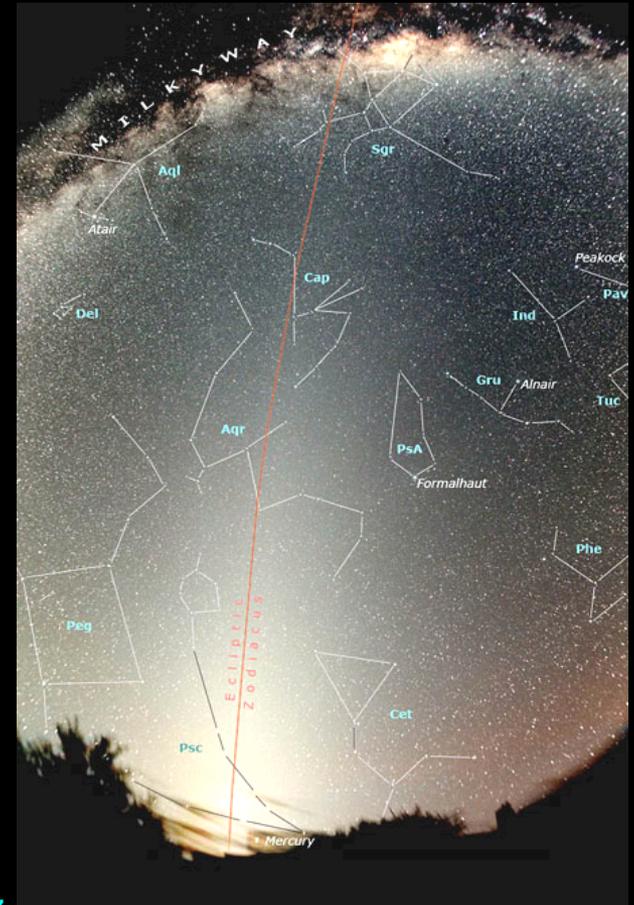
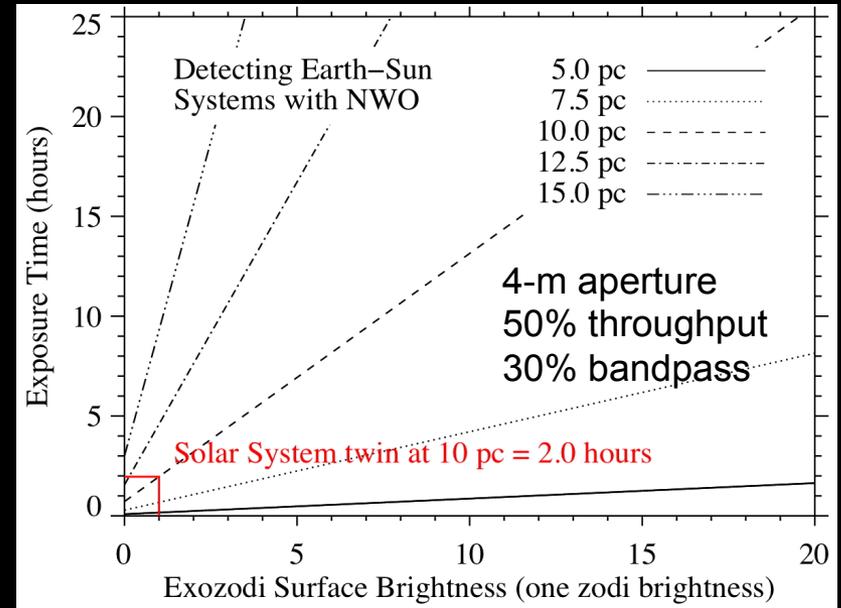


Image credit: S. Seip

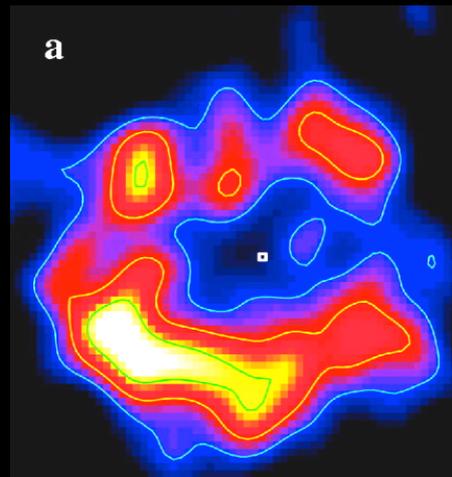
Impacts on Exoplanet Imaging

1. Background flux linearly increases imaging & spectroscopy exposure times



A. Roberge

2. Dust structures (produced by exoplanets) can cause confusion



Clumps
 ϵ Eridani @ 850 μm
Greaves et al. (2005)

Sensitivity to Exozodi Thermal Emission

For warm inner dust around solar-type stars ...

Current sensitivity limits

	3σ upper limit	Reference
Spitzer IRS	1000 zodis	Beichman et al. 2006
Keck single measurement	480 zodis	Millan-Gabet et al. 2011
Keck upper limit ensemble	< 150 zodis	Millan-Gabet et al. 2011

Upcoming sensitivity limits

	3σ upper limit	Reference
JWST MIRI (\geq 2018)	\sim 100 zodis	http://www.stsci.edu/jwst/instruments/miri/sensitivity/
LBTI (\sim 2012)	\sim 10 zodis	P. Hinz

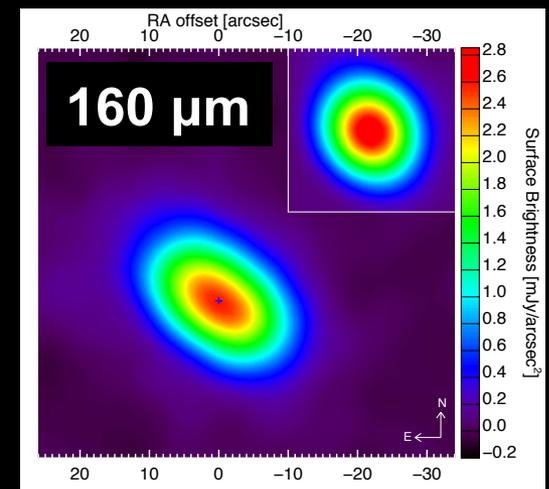
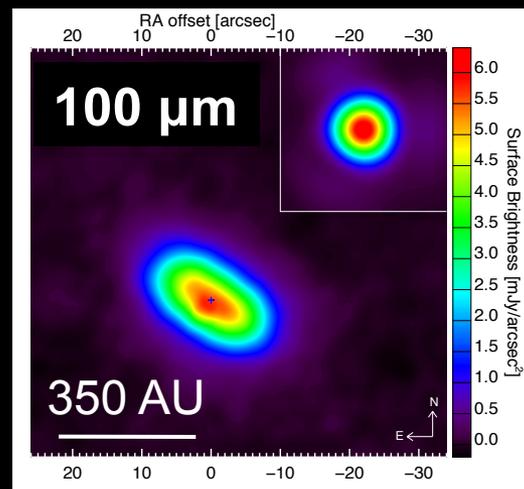
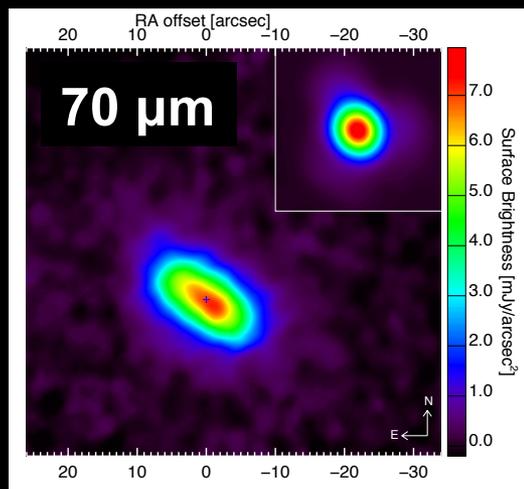
Herschel Open Time Key Programme

- “Dust Around Nearby Stars” (DUNES)

PI: Carlos Eiroa (U. de Madrid)

- 150 hours, far-IR imaging of 133 F, G, K stars
- Volume-limited ($d < 20$ pc) survey for cold debris dust
- Sensitive to analogs of Solar System’s Kuiper belt

q1 Eri



DUNES Progress Report

- ~ 87 targets observed (~ 65%)
- All detected at 100 μm ; planned sensitivity achieved
- Nearly $\frac{1}{2}$ of disks **spatially resolved**
- Nearly $\frac{1}{2}$ of disks **not previously known**
- Variety of spectral energy distributions seen
- Preliminary disk fraction ~ 30% with **cold dust \geq Solar System KB**

